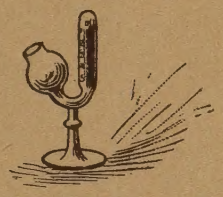
MANUAL OF

# URANALYSIS



A CONDENSED GUIDE
TO THE CLINICAL EXAMINATION
OF THE URINE

COMPLIMENTS OF
Hemaboloids

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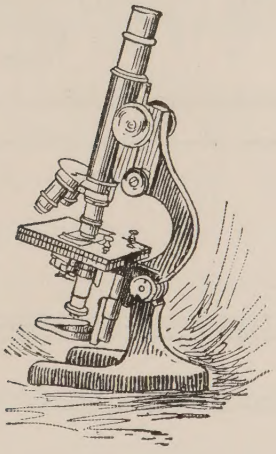
# MANUAL
## *of*
# *Uranalysis*

## A CONDENSED GUIDE TO THE CLINICAL EXAMINATION OF THE URINE



*Presented to Physicians by*

*ANDRUS & ANDRUS*

*46 Holborn Viaduct*

*London, E. C.*

*Representing THE PALISADE MANUF'G CO., New York.*

MAKERS OF Hemaboloids

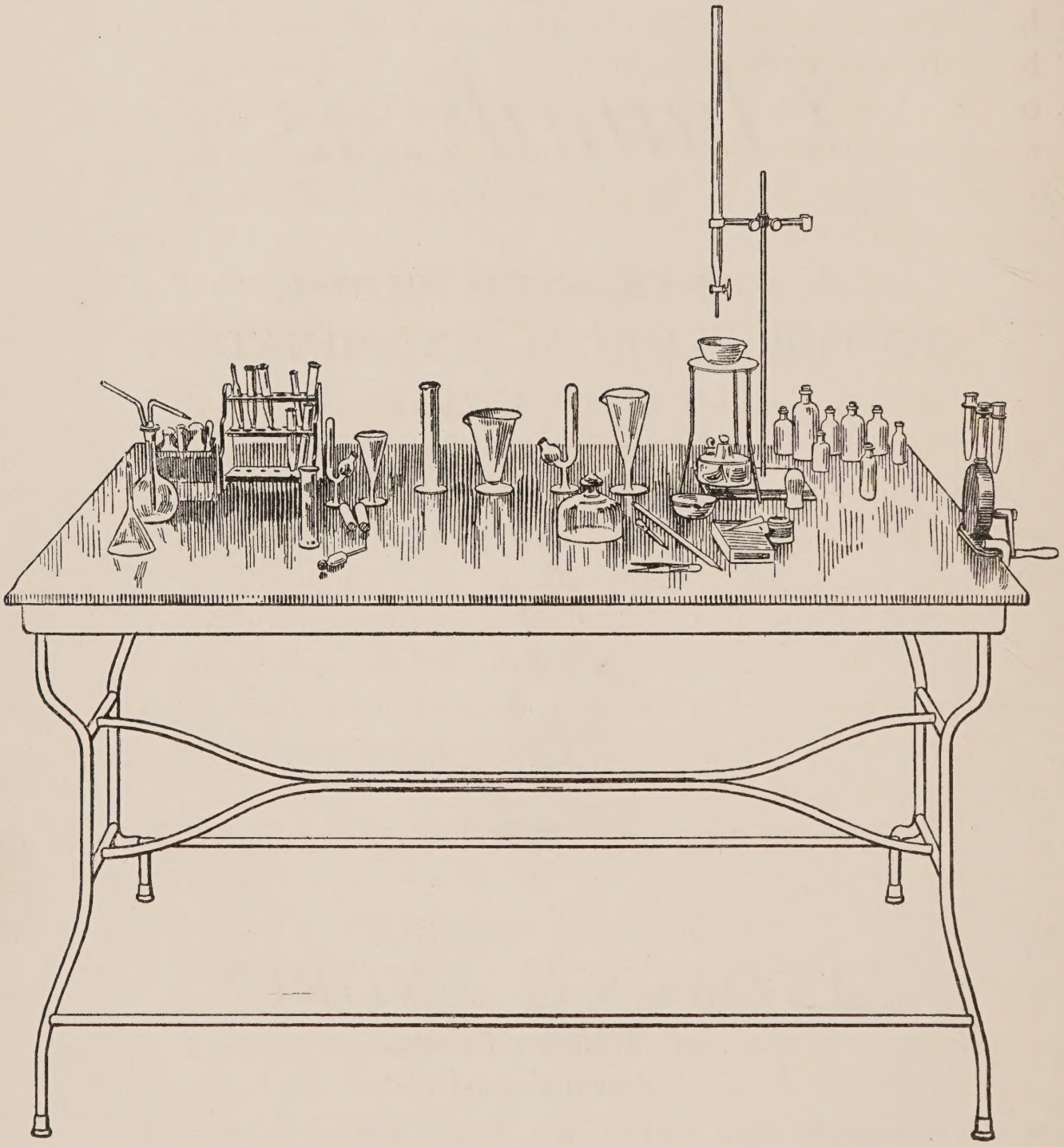


TABLE AND APPARATUS FOR URANALYSIS

# Introduction

It is not the design of the publishers of this little brochure to make it a complete work on uranalysis but rather to include in its scope only the technique of the common clinical tests as ordinarily required by the practitioner; for the clinical significance of the various findings the reader is referred to the usual text books.

It is deemed wise to describe but one method to each test, where one will suffice, and thereby secure brevity and avoid confusion.

In the selection of each test an effort has been made to make it the particular one most satisfactory, all things being considered. The points considered are accuracy, simplicity, practicability and brevity of time necessary for the procedure.

Some of the tests included are not the most accurate and are not such as would be adopted in the well equipped laboratory, but in such instances the question of practicability has outweighed the necessity for great accuracy.

No effort has been made to include the tests rarely required or the tests so complicated as to be beyond the facilities of the physician's laboratory.

In the arrangement of the subject matter a departure is made from the usual, and is taken up in about the order of a complete clinical examination, which form we believe will facilitate and simplify the work.

ANDRUS & ANDRUS,
46 Holborn Viaduct, London, E. C.
Representing
THE PALISADE MANUF'G CO., New York.

## TRANSPARENCY

The urine may vary in transparency from a perfectly clear fluid to a milky turbidity. It may be described accordingly as clear, slightly turbid, moderately turbid and very turbid.

If the turbidity clears up upon the addition of acetic acid, it is due to phosphates. If it does not do so, but clears up after heating, it is due to urates.

If the turbidity remains after the urine is filtered, it is due either to bacteria or blood, as both readily pass through filter paper.

## COLOR

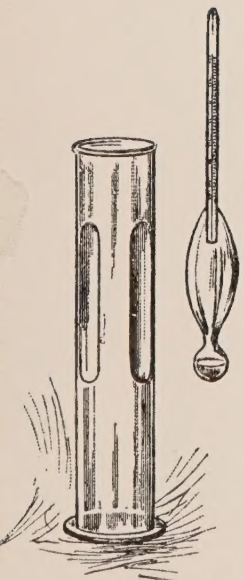
The color of urine varies widely under various conditions. Normally it is of an amber tint, the depth of color depending somewhat upon the concentration.

Under abnormal conditions it may vary from a colorless, watery condition to straw color and all shades of amber to a smoky brown or deep red. Again depending upon substances in suspension, it may be grayish, pink, milky or brown.

## SPECIFIC GRAVITY

Normally the specific gravity of the urine varies from 1.012 to 1.024. Abnormally it varies from 1.001 to 1.040 or more.

In determining the specific gravity there is a series of details which, if not carefully adhered to, may be the means of serious error.



SQUIBB'S URINOMETER WITH THERMOMETER

In the first place, make sure that your float and cylinder are properly made—a poor apparatus is worse than useless. The float may be tested by placing it in distilled water at the temperature stated on the float—if it does not state this, throw it away and secure one that does. If it is properly made, it will float at 1.000 under these conditions.

The cylinder should not be too small in diameter, else the float will impinge on its sides and thereby cause it to become fixed at a point either above or below the correct reading. An excellent cylinder is one with flutings in its sides which present nothing more than points to the float. A urinometer constructed on proper principles is made by Squibb. This may be obtained with or without a thermometer. This last article is a necessary adjunct when it is understood that the specific gravity of a fluid varies with its temperature, one degree of specific gravity for every seven degrees of temperature. At higher temperatures the fluid is greater in bulk, and therefore the float will sink lower; or at colder temperatures it

## SPECIFIC GRAVITY

is smaller in bulk and the float rises. For example, should the float be intended to read at 67° F. and the urine tested is at 88° F. the reading would vary three degrees too low, and therefore three degrees should be added. The rule is to add one degree specific gravity for every seven degrees of temperature, when the temperature exceeds that stated on the float, and to subtract one degree specific gravity for every seven degrees below. It is perhaps unnecessary to add that the float should be kept perfectly clean.

Finally determine whether the float is intended to be read from the top or the bottom of the meniscus. They vary in this respect, but are usually intended to be read from the top. In either event there is usually a variation of two degrees in the readings from the top and the bottom.

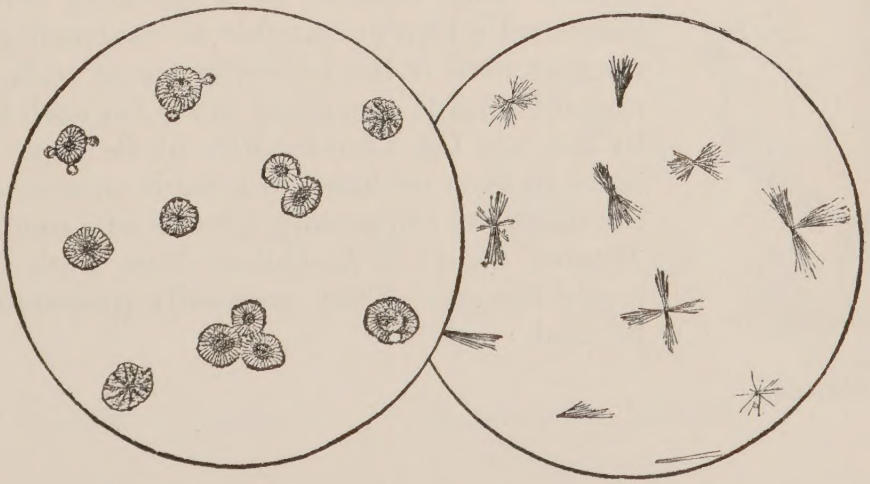
## TOTAL SOLIDS

It is hardly possible for the medical practitioner to find time to determine the total solids in a urine, as is done in the laboratories, but by aid of the specific gravity he can make an estimation sufficiently accurate for all practical purposes. To thus determine, multiply the last two figures of the specific gravity by 2.33. This will express the solids in parts per 1000 or grammes to the litre. Example, Specific gravity, 1.017 — last two figures 17x2.33 equals 39.61. The total solids for such a urine, then is 39.61 parts per 1000 or 39.61 grammes to the litre.

## REACTION

There are four reactions of urine—acid, alkaline, neutral and amphoteric.

To test the reaction use red and blue litmus paper. Dip the paper in the urine and if the blue changes to red it is acid, if the red changes to blue it is alkaline; if neither changes it is neutral; if both change, the blue to red and the red to blue, it is amphoteric. The paper is best obtained in narrow strips put up in vials and should be kept well stoppered or it it will rapidly deteriorate.



*Leucin Crystals* *Tyrosin Crystals*

## TOTAL QUANTITY

The total amount of urine voided in twenty-four hours varies from 1000 to 2000 cubic centimeters, or approximately one to two quarts, though through varied conditions of diet, etc., it may depart widely from these quantities without there being evidence of disease. It is usually wise to instruct the patient as to what is meant by a 24-hour specimen. At the time set for beginning the collection, the bladder is to be emptied and its contents not saved; the hour is noted, however, and all that is passed from then until the same hour the next day is saved. If the patient thoroughly mixes this and measures it, he need send but about 8 ounces for examination, with the total quantity stated.

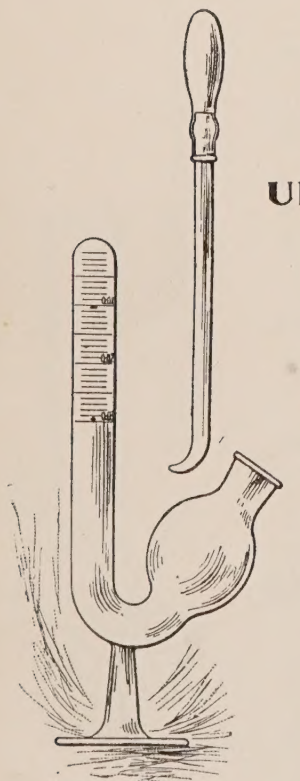
An examination of a single sample passed at any one time is of little value and may lead to seriously erroneous deductions.

## CHLORIDES

A rough but satisfactory determination of the presence or absence of chlorides may be made by adding a drop of a 12 per cent solution of nitrate of silver to a little urine acidulated with nitric acid. If they be present in excess there will be a heavy dense precipitate. If diminished, the precipitate will be less dense, and if absent, no precipitate will form.

If the urine contains albumin, it should be acidulated, boiled and then filtered before applying the test.

## UREA



DOREMUS' UREOMETER

An examination of urine is incomplete without an estimation of the amount of urea as no other means will satisfactorily determinate the functionating powers of the kidneys.

The estimation may be quickly made by use of the Doremus ureometer. This consists of a specially constructed tube with graduations and a pipette capable of measuring one cubic centimeter. The reagent used is the hypobromite of soda. This solution is, however, unstable and is commonly made for each test; but the formula devised by the late Dr. Charles Rice of Bellevue Hospital enables the physicians to keep on hand two stable solutions ready for use and obviates the necessity of opening a bottle of bromine every time a test is made. Messrs. Eimer & Amend of New York City sell these two solutions ready for use. They are easily prepared, but pure chemicals should be used.

**FORMULA**

| | | |
|---|---|---|
| Sol. A. | Sodium hydroxid ..... | 400 grammes |
| | Water ..... | 1000 cc. |
| Sol. B. | Bromine ..... | 125 grammes |
| | Sod. Bromide ..... | 125 grammes |
| | Water ..... | 1000 cc. |

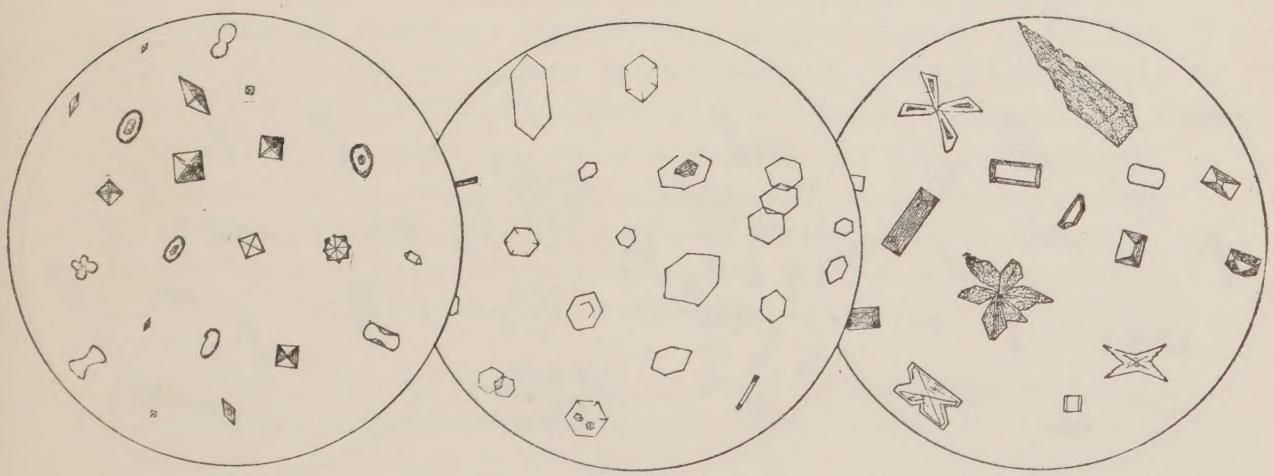
For use, take one part of each solution and three parts of water.

In making the determination fill the tube with the sodium hypobromite so that no air remains in the blind end. Then with the pipette measure one cc. of the urine and carefully and quickly pass its curved beak back into the bottom of the filled tube as it is tilted forward, to prevent escape of gas. Then gently pass the urine out of the pipette by means of the nipple attached, until it is entirely emptied. The lighter urine rises to the top through the hyobromite solution and its urea is decomposed, giving off two gases, one of which is reabsorbed; the other, the nitrogen, is collected at the top, and as soon as the frothing ceases the quantity of urea may be read off directly by means of the empirical graduations on the tube.

These are graduated in two ways, one reading grains to the ounce, the other in the metric system. The latter is better because one is enabled by it to read directly in percentage.

If, as is rare, the urine contains more than 3 per cent of urea it will be necessary to do the test again, using urine diluted half with water and of course multiplying the percentage thus obtained by two.

The normal quantity is from one to three per cent. If much less than one per cent, the patient is retaining in his system poisonous products which should have been eliminated. If more than 3 per cent his loss is greater than his gain and his metabolism is accordingly on the down grade.



*Calcium Oxalate Crystals* *Cystin Crystals* *Triple Phosphate Crystals*

## INDICAN

Indican or indoxyl potassium sulphate is a normal constituent of urine, in small quantities, but with putrefaction in the intestinal tract, it becomes increased and may thus be the means of determining a disturbance otherwise overlooked.

The test is very simple. To about 10 cc. of urine in a test tube add about an equal quantity of hydrochloric acid and after thorough mixing add a few drops of peroxide of hydrogen and mix again. Allow this to stand until it attains its maximum intensity of color, then add about two cc. of chloroform and thoroughly agitate. Now allow the chloroform to settle to the bottom of the tube. In a normal urine this will be bluish white, but in increased amounts of indican it will be more or less deeply blue, even to a deep indigo in the presence of a great excess.

Incidentally, if iodides are present, either through ingestion or absorption, as from iodoform, the chloroform will have become colored anywhere from a pale rose violet to an intense reddish violet. In the presence of both indican in excess and iodides, there will be a combination of both the blue and violet.

## BILE

The presence of bile may readily be determined by placing a drop of nitrous acid on the filter paper through which the urine has been filtered for the albumin test. If bile be present there will appear a zone of green around the margin of the drop. Other colors may also appear, due to indican, urobilin, etc., but the green is characteristic of bile.

## ALBUMIN

There are no perfect and infallible tests for albumin, a fact which accounts for the array of tests with which most text-books on urin-

*Calcium Phosphate Crystals*

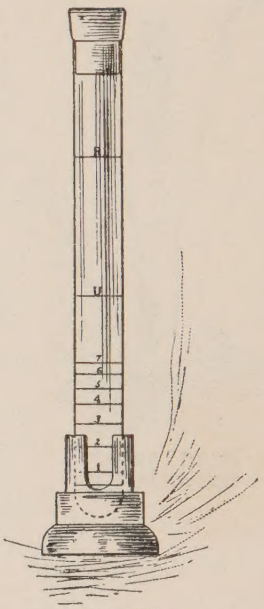
*Epithelial Cells*

*a Pus cells for Comparison*
*b Bladder cells*
*c Renal cells*
*d Pelvic cells*
*e Vaginal cells*

*Blood Casts*

ary analysis are burdened. A departure from the "rule of one" designed at the beginning of this brochure will here be made, and two methods will be given for the same determination.

The first method will determine any quantity of albumin worth considering. Filter a test tube two-thirds full of urine and grasp the tube by its lower end and heat the upper inch or so of fluid in a flame until it comes to the boiling point. Now hold the tube up in front of a dark background, with the light coming from one side, and observe whether there is any turbidity in the top portion not found in the lower strata. If a turbidity exists, it is due either to albumin or to phosphates or to both. Now add a drop of acetic acid and if the turbidity be due to phosphates it will quickly be dispelled but if it be due to albumin it will become even more marked. Sometimes it happens that both albumin and phosphates are precipitated by heat in which event so much of the turbidity as is due to phosphates will be dispelled by the acid and that which is due to albumin will remain. It is well to bear in mind that an excess of acid may redissolve the albumin.



ESBACH'S ALBUMINOMETER

It sometimes happens that the filtered urine is not clear; this is usually due to great quantities of bacteria and does not interfere with the test more than to make it somewhat more difficult to make comparisons as to turbidity. The filtering of the urine is always essential to the proper performance of this test.

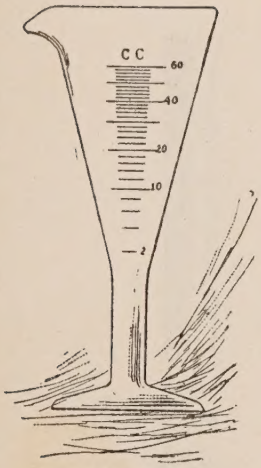
The second test is perhaps the most popular, but is not so accurate in the determination of small quantities of albumin.

In a test tube place a half dram or so of nitric acid and allow some filtered urine to gently flow down the side of the tube and overlay the acid. If albumin be present, a whitish opaque layer will form immediately at the point of junction of the two fluids. With this test there is also a zone of reddish or brownish color due to the pigments in the urine and sometimes there is an indistinct whitish zone above the point of contact which must not be mistaken for evidence of albumin which must appear immediately at the point of contact.

There is a neat little apparatus that is useful for applying this test; the albumoscope, which is really nothing more than a short test tube with a thistle tube at its side by means of which the nitric acid may be added to the urine from below. A band of black painted on the side of the tube furnishes a suitable background for observing the reaction.

Both these tests are simple and one soon becomes able to make fairly accurate determination as to quantities.

## ALBUMIN



TEST TUBE GRADUATED

Both tests react to the resins, such as copaiba, benzoin, cubebs sandalwood, balsam of Peru, etc. but all are soluble in alcohol, which is not so of albumin.

For quantitative estimation of albumin nothing is more satisfactory for the practitioner than Esbach's albuminometer. This is a specially constructed test tube, with graduations marked on its side ranging from 1 to 7, and above these are two lines, one midway marked U and another near the top, marked R. The reagent is known as Esbach's fluid, the formula for which is as follows:

Picric acid.....10 grammes
Citric acid.....20 grammes
Water .....1000 cc.

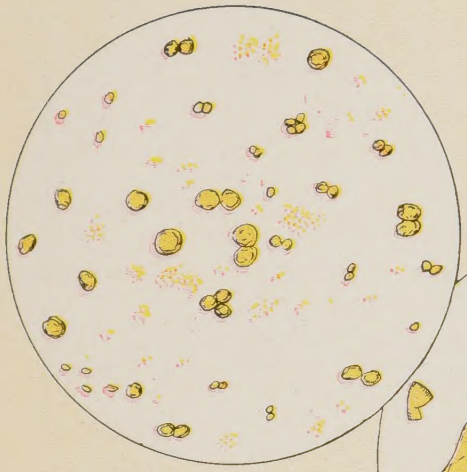
To apply the test, fill the tube with filtered urine to the line marked U and then with the solution to the line marked R. Close the tube with a rubber stopper, and after thoroughly mixing the contents, place it aside to stand for twenty-four hours at the end of which time note is made of the level to which the precipitate rises. If to the line 1, it indicates one part of albumin per 1000 by weight or 1 gramme to the litre; if to the line 2, two parts per 1000, and so on, up to seven, but if five parts or more are indicated, the test should be repeated, using urine diluted one-half with water and then multiplying the result by two.

## PEPTONE

Acidify about 500 cc. of urine with acetic acid and boil to remove the albumin. Filter this and add about 5 cc. of hydrochloric acid and then precipitate the albumoses by the addition of about 3 cc. of a 10 per cent phosphotungstic acid. Now heat the mixture very gently until the precipitation is completed. Allow this tc settle and pour off the clear supernatant fluid and wash the sediment two or three times with distilled water. Again heat the sediment and add carefully, a drop at a time, a solution of 30 per cent ammonia. If the fluid now appears blue, continue adding the ammonia until it becomes colorless. After this has been allowed to cool, place some of it in a test tube and add one drop of a one per cent solution of copper sulphate and if peptone be present, an amethyst-red color will appear.

## SUGAR

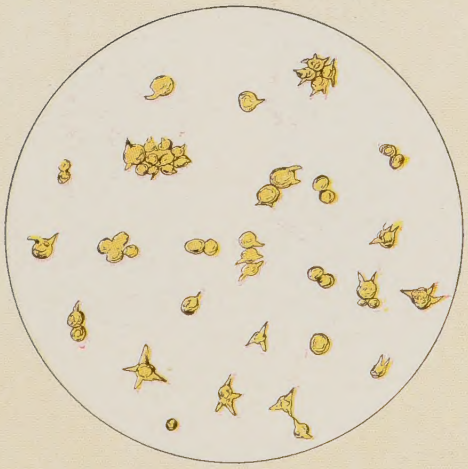
The physician has not at his disposal any infallible test for glycosuria. Therefore he must make the best of what is presented.



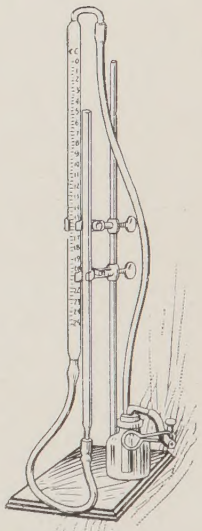
SODIUM
URATE

URIC ACID
CRYSTALS

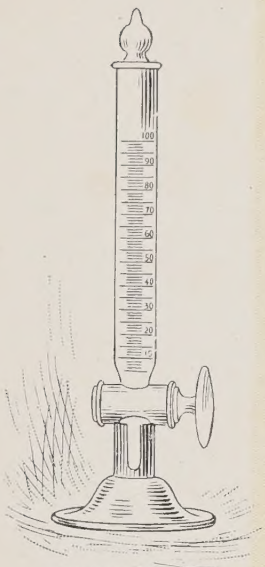
BILE
REACTION



AMMONIUM
URATE



SMITH'S
UREOMETER



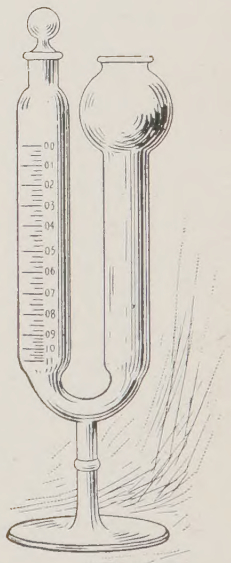
PURINOMETER

FEHLING'S REACTION

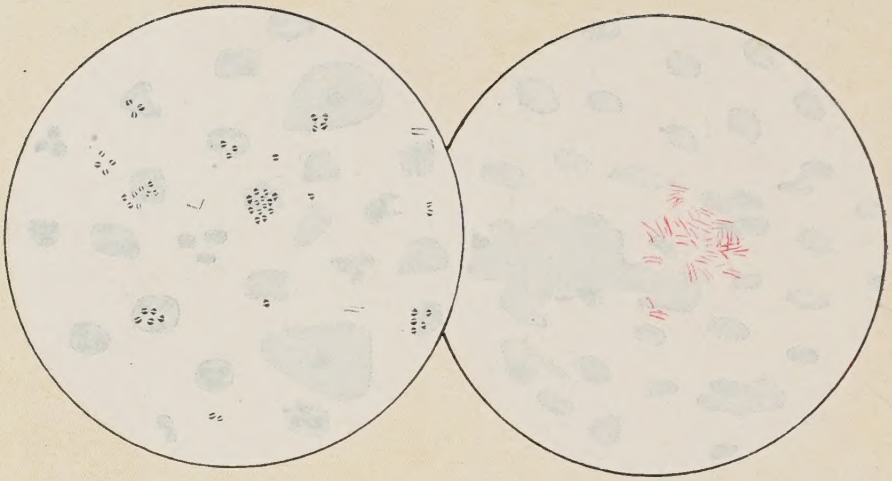
INDICAN AND IODINE REACTION

*a* Normal
*b* Moderate
*c* Excessive
*d* Iodine

DIAZO REACTION



LOHNSTEIN'S SACCHAROMETER



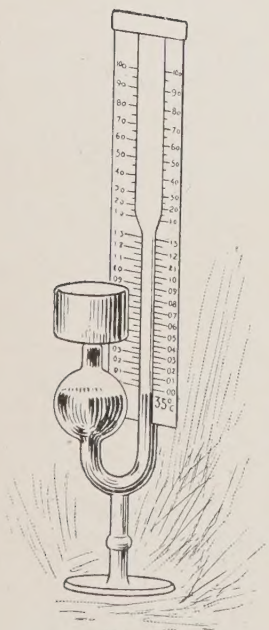
GONOCOCCI IN PUS

TUBERCLE BACILLI IN URINE SEDIMENT

BLOOD SEDIMENT

AMORPHOUS URATES SEDIMENT

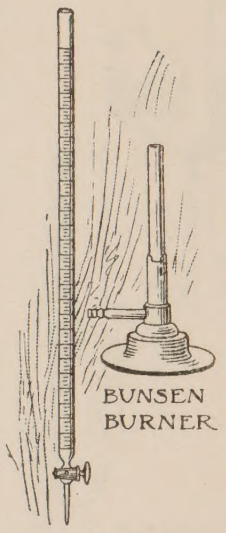
PHOSPHATE SEDIMENT



FERMENTATION SACCHAROMETER

Fehling's method is perhaps the best, all things being considered, and it is certainly the most popular in the hands of laboratory workers. To be of any value, Fehling's solution must be just right, and reference to its formula in any of the textbooks will convince one that not only is it impossible for the physician to prepare it even to approximate accuracy, but very few druggists can do much better.

Fortunately this difficulty is easily overcome. Messrs. E. R. Squibb's Sons have on the market small sets in convenient form, containing the two solutions in separate bottles. Or in case larger quantities are desired, the elements may be obtained in 500 gramme bottles.




As ordinarily applied, one cc. of each of the solutions is placed in a clean test tube and diluted with about four times this quantity of water. Heat, but do not boil the solution and if it still remains clear, it is evident that the solution has not deteriorated and that the test tube contains no reducing agent.

Add one drop of urine to the solution and again heat just short of the boiling point, which must be avoided. If no change is noticeable, add another drop and again heat, and so continue until about fifteen drops of urine have been added, and then if no change has been observed, place the tube aside to cool and if still no change is apparent, it may safely be assumed that there is no glycosuria.

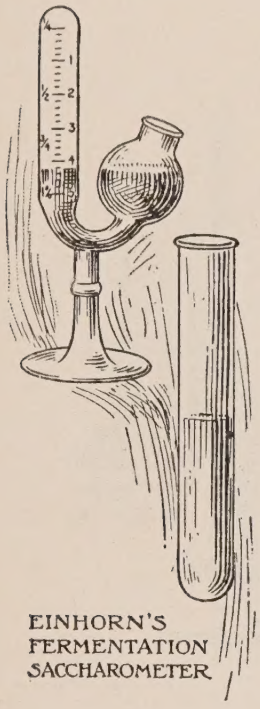
If sugar is present, a precipitate of the suboxid of copper will form. If it is in great abundance it will quickly form upon the addition of the first drop of urine, if somewhat less, it may not appear until the second drop is added, and thus diminishing amounts will become manifest by the increasing number of drops required to bring about the reaction.

The characteristic reaction is at first yellowish in color. This later becomes reddish and after sedimentation is completed, the bright red or suboxid of copper will be seen at the bottom of the tube.

Extraordinary care must be used in the handling of the two reagents. They must be kept in the dark, and the stopper must not be interchanged—in other words, avoid any admixture of the two solutions.

Occasionally in the hands even of the experienced, reactions are obtained which are doubtful because of some medication or perhaps of a great excess of urates. On such occasions a control test may be made by the fermentation method, which is described under quantitative estimation.

## QUANTITATIVE ESTIMATION OF SUGAR



EINHORN'S FERMENTATION SACCHAROMETER

Two methods are at our disposal, Fehling's and the fermentation method. To prepare Fehling's the following things are required:

A 100 cc. burette graduated to tenths,

A porcelain dish of about 100 cc. capacity,

A burette stand,

An alcohol lamp, or Bunsen burner,

A stirring rod.

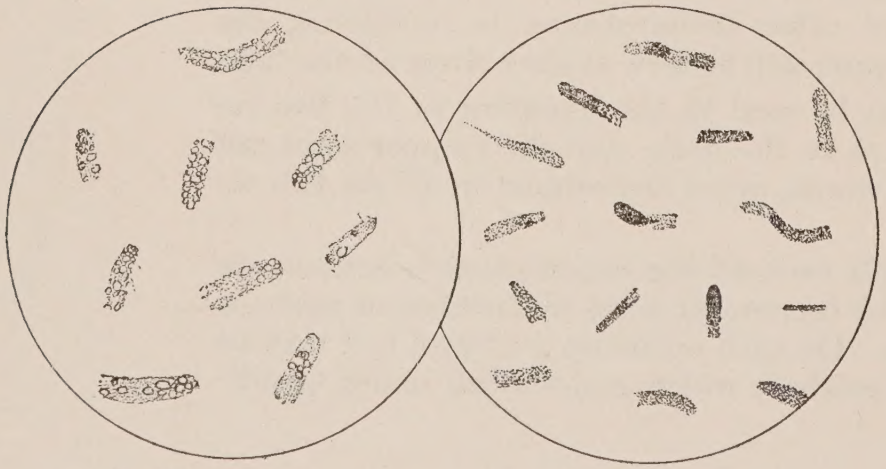
Dilute 100 cc. of Fehling's solution with 40 cc. of water. Place it in the dish and boil and if it remains blue and clear it is ready for use.

If the specific gravity of the urine be less than 1.030, dilute some of it to one to five. If above 1.030, dilute it to one to ten. Fill the burette with the diluted urine, and, drop by drop, add to the heated copper solution, stirring it the while, until all the copper is reduced, or until it has been precipitated as the suboxid of copper and the supernatant fluid has become clear and colorless. When this point has been reached, (and one must be careful to recognize it when it occurs) a reading is to be taken of the quantity of urine consumed from the burette. Now multiply the degree of dilution by 5 and then divide by the amount of diluted urine consumed and the result will be the percentage of sugar. Example: dilution 5x5 equals 25. Amount of urine used, 2.5 cc. 25 divided by 2.5 equals 10. Percentage of sugar, 10.

With the percentage known, one may readily reckon the quantity of sugar in 24 hours' collection, when that is known.

## FERMENTATION METHOD

One should have three or four Einhorn saccharometer tubes. These are specially prepared, graduated tubes like the illustration. These are not capable of estimating more than one per cent, so the urine should be diluted where the percentage is higher. A rough estimate may be made by the specific gravity and by the qualitative test by Fehling and through these determine the degree of dilution necessary, and by having a



*Fatty Casts* *Granular Casts*

## FERMENTATION METHOD

number of tubes on hand, varying dilutions may be used and thereby the correct one is more likely to be hit upon.

Having decided upon the dilutions, prepare them and place them in test tubes, 10 or 15 cc. each. To each tube add about one-sixteenth of a cake of Fleischman's yeast and shake each until the yeast cake is well mixed with the urine. Prepare also one tube with water and yeast, as a control, to prove that the yeast itself does not contain sugar as occasionally is the case.

Fill the saccharometer tubes with the mixtures, marking each with the dilution used and place them in a warm place for about six hours, or until gas is no longer being formed. At this stage the level of the fluid is noted in the graduated end of the tube and the percentage is read directly from the graduations. If diluted urine is used, it will be necessary to multiply the percentage thus obtained by the degree of dilution.

This test is based on the fact that yeast in its growth consumes the sugar, and in so doing produces alcohol and $CO_2$. The amount of this gas, when measured, gives the quantity of sugar consumed. The tubes are so graduated as to express this in percentage. Of course, if the control tube contains gas, it is evident that the yeast contains sugar, and therefore the entire test will have become nullified and the test must either be repeated with new yeast or the sugar may be washed out of the yeast by agitating it in two or three flasks of water and filtering it after each washing.

## ACETONE

To a test tube half full of urine add a few drops of strong sodium hydrate and a 5 per cent solution of nitro-prusside of sodium. The mixture will be red, but will turn to purple or violet by the addition of an excess of glacial acetic acid, in the presence of acetone.

*Pus Casts* *Epithelial Casts* *Hyaline Casts*

## DIAZO REACTION

In the performance of this test three solutions are required, viz.

| | | |
|---|---|---|
| Sol. A. | Hydrochloric acid, | 5 per cent. |
| | Sulphanilic acid, | 1 per cent |
| Sol. B. | Sodium nitrite | 0.5 per cent. |
| Sol. C. | Concentrated ammonium hydrate | |

The test is best prepared by using a test tube-like cylindrical graduate of about 15 cc. capacity. The solutions should be prepared just before using, as they are not stable.

Take 2.5 cc. of Sol. A., add one drop of Sol. B. and then fill with urine to the 5 cc. mark. Now add an excess of the ammonia gently, so as to overlay the mixture and a crimson color will appear at the line of contact. All urines will give color, but if the reaction is positive it will be a crimson or garnet. As further proof of its positiveness, place the thumb over the end and agitate the mixture, and the color will be apparent in the foam as well as throughout the mixture.

It is suggested that the physician make this test with normal urine a few times to acquaint himself with the colors produced in negative tests, the better to prepare him to recognize the test when positive.

## URIC ACID

The normal quantity of uric acid eliminated by the adult, in health varies from 0.3 to 1.25 grammes per day.

We have not at our disposal any simple, easily performed test which is at the same time accurate.

But one suggestion will be made to enable one to arrive at some idea as to whether the quantity is increased or diminished. Ability to so judge will depend upon some little practice on urines of apparently healthy individuals. Place two hundred cc. of filtered urine in a conical sedimenting glass and add 10 cc. of hydrochloric acid. Stir the mixture and allow it stand twenty-four hours, and at the expiration of this time loosen all the crystals which have adhered to the side of the glass and note the amount of crystals at the bottom. Having established the standard for normal, the

*Cylindroids* *Waxy Casts.*

varying degrees of departure from it may be judged by comparison. Or if one has a balance of sufficient accuracy, he may wash the crystals in water and collect them on a filter paper of known weight and then weigh the paper again after complete dessication. The difference in weight will be the approximate quantity of uric acid in 200 cc. of urine and from this the quantity in the total amount of urine for twenty-four hours may be estimated.

## DIACETIC ACID

Von Jaksch suggests the following method for the detection of diacetic acid. To some urine in a test tube carefully add a solution of perchloride of iron and if, while doing so, the phosphates are precipitated, they must be filtered out and the perchloride again added. A Bordeaux red-color appears in the presence of diacetic acid and also of salicylic acid and carbolic acid. In another tube treat in a similar manner some urine which has been boiled, and if the reaction in the first instance was due to diacetic acid, it will not appear in the second, but will appear if due to the other substances.

## EARTHY PHOSPHATES

The simplest means of determining the relative quantity of earthy phosphates is that suggested by Ultzmann: Fill a test tube 2 cm. wide, with urine to a depth of 5 2-3 cm. Add a few drops of concentrated ammonia and after allowing the tube to stand 15 minutes note the depth of the sediment. One cm. is normal, a greater amount would indicate an excess and a lesser, diminution.

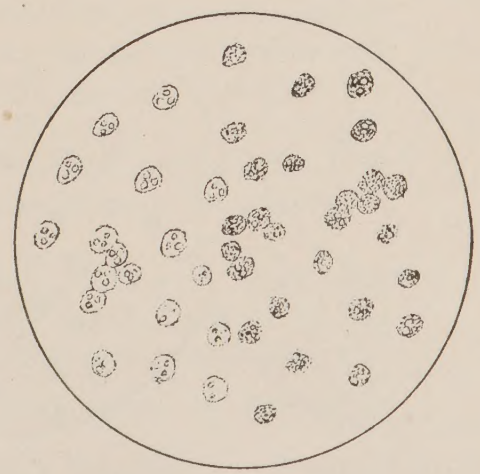
## SULPHATES

The usual quantitative tests for sulphates are hardly available for the medical practitioner, but the following simple procedure will amply serve his purpose.

Prepare the following solution:

| | |
|---|---|
| Barium chloride, | 4 parts. |
| Concentrated hydro. acid, | 1 part. |
| Distilled water, | 15 parts. |

Half fill a test tube with filtered urine and add about 5 c.c. of the solution. Allow the precipitation to become complete and if more than half of the cavity of the tube be filled, the sulphates are increased. If less than this they are diminished.



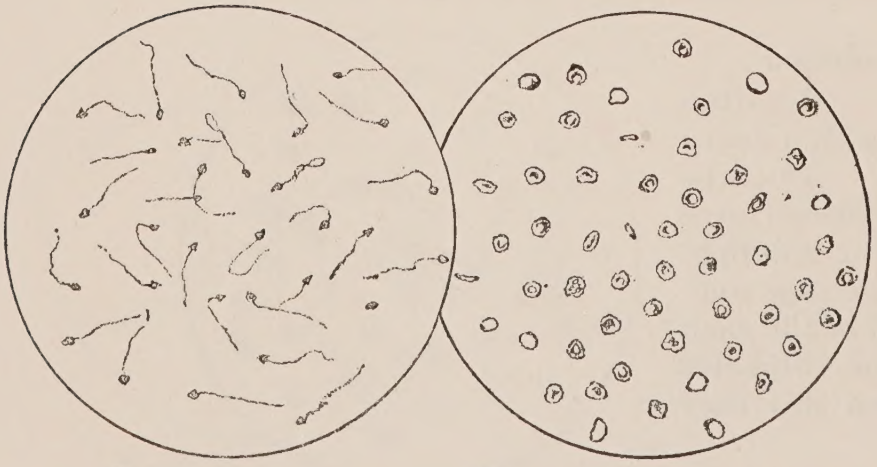
*Pus Corpuscles*
*On right – Normal*
*On left – After Acetic Acid*

## MICROSCOPIC EXAMINATION OF URINE

For the microscopic examination of urine, the sediment is requisite. This may be obtained by allowing the urine to stand in a conical sedimentation glass. Many urines will not thoroughly sedimentize in less than five hours, and if certain bacteria are present, this lapse of time may be sufficient to entirely alter its character, especially if the weather be warm. Since the centrifuge has reached its present perfection and slight cost, there is really no excuse for working without one. The advantages of its use are very great. Centrifuges are made for hand, water and electrical power, and vary in price from $7.50 to $20.00. The writer has had one of the water power forms in daily use for more than five years, and it has never failed to work satisfactorily. It is quickly attached to and removed from an ordinary faucet. Small tapering glass tubes are supplied with all centrifuges. The tubes are to be filled with urine. centrifuged for three minutes and the sediment is obtained in the best possible shape.

To get sediment up and on a slide, it is best to use a glass pipette. The best size tubing is about 1-8 inch calibre inside and should be cut in 8-inch lengths. It is not necessary to taper the ends, but it is best to round the cut ends by bringing them to a red heat in an alcohol or Bunsen flame.

For those without experience in drawing up sediments with a pipette, a few words of advice are perhaps not amiss. With the index finger over the upper end of the pipette, push the lower end to the bottom of the glass or tube, and with the eye watching the behavior of the sediment, gently manipulate the finger at the top so as to allow a little of the sediment to be drawn into the tube, say to the height of an inch; then draw the tube out and let the sediment flow upon a clean slide. Upon this drop a clean cover glass, and the specimen is ready for microscopic examination.

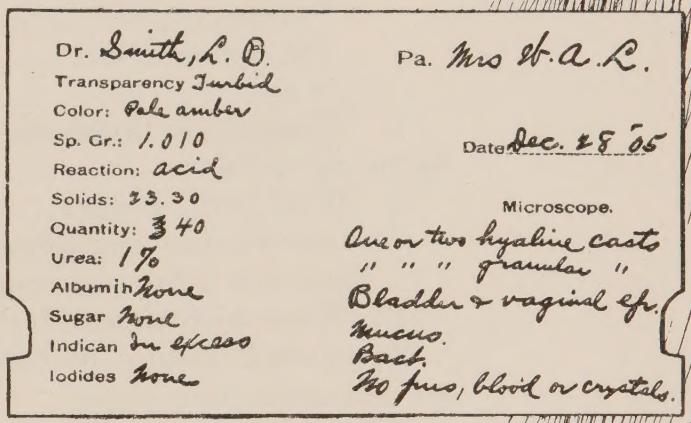


*Spermatozoa* *Blood Corpuscles*

Two powers are ordinarily used, a 2-3 and 1-6 objective with a one inch eyepiece. Most of the work should be done with 2-3, holding the 1-6 in reserve only for objects too small to be studied with

the lower power. Do not neglect to keep the diaphragm well closed for these low powers, as with the diaphragm too wide open, very little of the sediments can be seen. With the 1-6 objective the diaphragm should be opened a little more than for the 2-3.

The two bacteriological examinations principally required by the practitioner are for tubercle bacilli and gonococci. To properly make these a centrifuge is really requisite. For either examination, fill a centrifuge tube with urine and centrifuge it for five minutes or so, when the sediment will be well packed in the bottom of the tube. The tube can now be turned upside down and the sediment will remain in the bottom. Remove a portion of this with a platinum loop, spread it on a cover glass, dry the smear and pass it three times through a flame, slowly enough to "fix it,' but not so slowly as to char it or turn it a brown color. These steps apply to preparations for both tubercle baccilli and gonococci; but from this on the procedure is different.


Dr. Smith, L. B. Pa. Mrs H. A. L.
Transparency Turbid
Color: Pale amber
Sp. Gr.: 1.010 Date Dec. 28 '05
Reaction: acid
Solids: 23.30
Quantity: 340 Microscope.
Urea: 1%
Albumin None
Sugar None
Indican In excess
Iodides None
One or two hyaline casts
" " " granular "
Bladder & vaginal epi.
Mucus.
Bact.
No pus, blood or crystals.

To examine for tubercle bacilli place the cover glass in a pair of forceps with the smeared side up, cover the entire surface with carbol-fuchsin which can be purchased ready prepared but can be made according to the following formula:

Saturated alcoholic solution neutral fuchsin, 10 cc.

5% carbolic acid water, 90 cc.

When the dye is on the smear, hold it over a flame and heat until steam arises, but do not boil it. Then let it remain in contact for about a minute and wash off the excess of dye with water and thoroughly decolorize with a five per cent solution of sulphuric acid, say for about one minute, and then continue the decolorizing with alcohol for the same length of time. Wash the smear again with water and counterstain with a saturated aqueous solution of methylene blue for one minute. Finally wash with water, dry and mount in Canada balsam on a slide. Examine with a 1-12 oil immersion objective and have the diaphragm wide open. Tubercle bacilli will be stained a bright red, all other organisms blue.

To determine the presence or absence of gonococci, stain one smear merely with methylene blue, wash, dry and mount as in the process just described. Examine with a 1-12 objective and look for the kidney-shaped diplococci within the protoplasm of pus cells.

If such are found, one may not be certain as to whether they are true gonococci or some pseudo form. To decide this a more complicated procedure is necessary with another smear. It must be stained by the Gram method, followed by a contrast stain. The following are the steps:

1. Prepare an emulsion of about 8 drops of aniline oil in a half ounce of water by shaking in a test tube;
2. Filter this through a wet filter, and if the filtrate be clear
3. Add a sufficient quantity of a saturate alcoholic solution of gentian violet to make it opaque:
4. Stain the smear with this for one minute;
5. Wash with water;
6. Soak in Gram's solution one minute.

Gram's Solution.

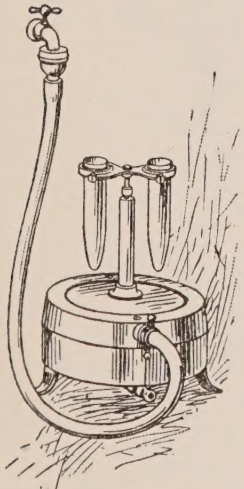
| | |
|---|---|
| Iodine crystals | gramme 1. |
| Potassium iodide | gramme 2. |
| Water | 300 cc. |

7. Thoroughly decolorize with alcohol, or until the alcohol takes up no more color;
8. Wash with water;
9. Counterstain five minutes with a saturate solution of Bismarck Brown in a five per cent carbolized water;
10. Wash with water, dry and mount.

After such treatment true gonococci are stained a light brown, pseudo gonococci, violet.

Streptococci are readily recognizable by their chain, beaded appearance, and are best stained with methylene blue.

The remaining bacteria usually looked for in urine are not recognizable by mere microscopic examination, and their recognition falls within the province of the bacteriologist rather than the clinician.



WATER MOTOR CENTRIFUGE

## LIST OF CHEMICALS

Carbol fuchsin, 100 grams
Carbolic acid, one-half pound
Sulphuric acid, one-half pound
Methylene blue, 10 grams
Canada balsam, one tube
Aniline oil, one ounce
Saturate alcoholic solution gentian violet, 100 grams
Iodine crystals, one-half ounce
Iodide of Potassium, one ounce
Alcohol, one pound
Bismarck Brown, 10 grams
Copper Sulphate, one per cent solution, one ounce
Squibb's Fehling's Test Set
Sodium hydrate, one pound
Five per cent. solution, Nitroprusside of Sodium, two ounces
Sulphanilic acid, one ounce
Red and blue litmus strips, one tube each
Sodium Nitrite, one ounce
Perchloride of iron, one ounce
Barium chloride, one ounce
Nitrate of silver, 12 per cent solution, one ounce
Nitric acid, one pound
Hypobromite solutions, Dr. Chas. Rice's formula, one bottle each
Hydrochloric acid, one pound
Peroxide of hydrogen, one pound
Chloroform, one pound
Nitrous acid, 100 cc.
Glacial acetic acid, one pound
Esbach's fluid, one pound
10 per cent solution phosphotungstic acid, one ounce
Strong ammonia, one pound

## LIST OF APPARATUS

Platinum loop in glass rod
Half gross microscope slides
Half ounce cover-glasses, three quarter-inch, square, No. 1
Wash bottle, 250 cc. capacity
100 cc. burette, graduated to tenths
Porcelain dish, 100 cc. capacity
Burette stand
One alcohol-lamp or Bunsen burner
One glass stirring-rod, six inch
Three Einhorn saccharometers
Three conical sedimenting glasses, 4 to 6 ounce
One centrifuge
6 extra centrifuge tubes
Glass tubing, eighth inch calibre inside, cut into 8-inch lengths
Squibb's urinometer with thermometer
4 cylindrical graduates, ounce and metric, capacities, 1000 cc. 250 cc. 100 cc. and 15 cc.
Doremus ureometer
Round filter paper, 5-inch, one package
Albumoscope
Esbach's Albumenometer
Test tubes, six-inch, one gross
Three brush test-tube cleaners
Two 3-inch funnels.

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ARSENIATED
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This co-operative action renders the preparation especially useful in Intense Anemia, Chloro-Paludism and all conditions characterized by Tissue Waste and Persistent Decline.

Each tablespoonful represents the equivalent of 15 minims (1 Gm.) Tr. Ferri Chlor., $\frac{1}{40}$ gr. (1.6 Mgm.) Arsenious Acid and $\frac{1}{80}$ gr. (0.8 Mgm.) Strychnia

DOSE=One Tablespoonful 3 or 4 times a day Children in proportion.

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